

Serial No.:10/657,776

PATENT APPLICATION
Docket No.: NC 84,571

REMARKS

Claims 1-11, 12-16, and 18-40 are pending in the application. Claims 12 and 17 have been cancelled by this amendment without prejudice. Claims 31-40 have been added by this amendment. Claims 1-11, 13-16, 18-21, 23-25, and 28-30 have been rejected. Original claims 22, 26, and 27 have been objected to, but were held to recite allowable subject matter.

Paragraph 0047 is amended to add the phrase "was provided" to form a complete sentence.

Claims 1 and 30 have been amended to recite that the two or more electrical leads are on the surface of the substrate. Support for this amendment is found in cancelled claim 17.

Claims 1 and 30 have been amended to recite that substantially none of the carbon nanotubes is in contact with both of the leads. Support for this amendment is found in paragraph 0018.

Claim 4 is amended to add a missing "the."

New claims 31 and 35 recite that none of the carbon nanotubes/nanofilaments is in contact with both of the leads. Support for this amendment is found in paragraph 0018.

New claims 32 and 36 recite that at least one of the carbon nanotubes/nanofilaments are in contact with neither of the leads. Support for this amendment is found in Fig. 1.

New claims 33 and 37 recite that the substrate is substantially free of catalyst. Support for this amendment is found in paragraphs 0020 and 0029.

New claim 34 recites that the conductivity of the network is modulated by a voltage applied to the gate. Support for this amendment is found in paragraphs 0039-0044 and Fig. 3.

New claims 38-40 are equivalent in scope to original claims 22, 26, and 27, which have been held to recite allowable subject matter.

The replacement drawings contain only technical corrections without substantive amendments.

Information Disclosure Statement

The IDS filed on 09/08/2003 was not considered because the references were not available to the Examiner. The references are available in the image file wrapper under the titles "NPL Documents" on 09/08/2003. An additional IDS is also attached.

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The drawings were objected to for blurred text and small text. Seven replacement sheets of drawings containing all of the drawings in the application are attached.

Specification

The first sentence of paragraph 0047 was objected to as an incomplete sentence. By this amendment, the sentence is corrected as suggested by the Examiner.

Claim Objections

Claim 12 was objected to as being of improper dependent form failing to further limit the subject matter of a previous claim. By this amendment, the claim is canceled without prejudice.

Claim Rejections – 35 U.S.C. § 102

Claims 1-4, 6, 10-13, 15, 16, 24, 28, and 30 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Watanabe et al. (US 2004/0041154). Claim 1, as amended, is to an electronic device comprising a substrate, a gate electrode, an interconnected network of carbon nanotubes on the surface of the substrate; and two or more electrical leads. The network forms an electrical connection between the leads; and substantially none of the carbon nanotubes is in contact with both of the leads.

Watanabe discloses a carbon nanotube group 110, on a substrate 116, in contact with a pair of leads 114, 114' (Fig. 13). The reference does not claim both leads on the surface of the substrate. In any claim directed to two electrodes, the second electrode is on the cut end as shown in Fig. 8, and not on the surface of the substrate. As a published patent application that does not claim the presently claimed invention, Watanabe can be disqualified by a declaration by the inventors.

The attached Declaration Under 37 C.F.R. § 1.131 by all the present inventors incorporates a publication (*App. Phys. Lett.*, 82(13), 2145 (2003)) that is shown to be received by the publisher on 11/26/2002. The Declaration confirms that the article was sent to the publisher no later than that date. Fig. 1 shows a substrate with a carbon nanotube network and two leads on the surface. Figs. 2 and 3 show electrical data confirming that the network formed an electrical connection between the leads. The final paragraph beginning on page 2145 states that

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the average nanotube length is much shorter than the distance between the leads, so that current has to flow through inter-nanotube contacts. This confirms that none of the nanotubes is in contact both leads.

The Declaration shows possession of the invention of claim 1 by 11/26/2002. The filing date of Watanabe is 02/24/2003. The reference is disqualified as to any subject matter Watanabe discloses but does not claim.

Claims 2-4, 6, 10, 11, 13, 15, 16, 24, and 28 depend from and contain all the limitations of claim 1 and are asserted to distinguish from the reference in the same manner as claim 1. Claim 30 differs from claim 1 only in reciting nanofilaments instead of carbon nanotubes and is asserted to distinguish from the reference in the same manner as claim 1.

Further, as to claim 6, the Examiner stated that Watanabe discloses 100% semiconducting nanotubes and no metallic nanotubes, meeting the limitation of an upper limit to the density of metallic single-walled nanotubes. However, claim 6 also recites that at least some metallic nanotubes are present. This limitation is not met by Watanabe's 100% semiconducting nanotubes.

Claims 1-3, 11, 19-21, and 30 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Gu et al. (US 2004/0104129).

Gu discloses a device having a source, a drain, and a gate. A nanoelement structure connects the source to the drain. Gu is another patent application publication that does not claim the present invention, in that Gu does not claim that substantially none of the carbon nanotubes is in contact with both of the leads. The claims of Gu were amended on 10/26/2004, and the amended claims are attached. The broadest claims recite that a nanoelement contacts both electrodes, however, the term "nanoelement" is not defined in the specification. Claims such as claim 43 recite that the nanoelement is a nanotube. Thus, the single nanotube must contact both electrodes. Claims such as claim 44 recite a network of interconnected nanotubes in addition to the nanotube that contacts both electrodes. There are no claims to a network where there are no nanotubes contacting both electrodes.

The filing date of Gu is 11/26/2003, and the filing date of its provisional application is 11/27/2002. These dates are after 11/26/2002, the latest possible date for possession of the present invention. As explained above and in the attached Declaration, this reference is also

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disqualified as to any subject matter it discloses but does not claim.

Claims 2-3, 11, and 19-21 depend from and contain all the limitations of claim 1 and are asserted to distinguish from the reference in the same manner as claim 1. Claim 30 differs from claim 1 only in reciting nanofilaments instead of carbon nanotubes and is asserted to distinguish from the reference in the same manner as claim 1. Further, as to claims 33 and 37, dependent on claims 1 and 30 respectively, Gu does not disclose that the substrate is substantially free of catalyst. The only methods Gu discloses for forming the nanotubes is from catalyst that is placed on the substrate.

Claims 1-3, 13-15, 24, and 30 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Dai et al. (US 6,528,020).

Dai discloses carbon nanotubes connecting a pair of electrodes on a substrate. Dai does not disclose that there are no nanotubes contacting both electrodes. In each figure, there is at least one that spans the gap. The specification specifically states that "a number of the nanotubes are bridging adjacent [catalyst] islands" (col. 4, lines 8-9). As the limitation is not disclosed in Dai, the claim is not anticipated.

Claims 2-3, 13-15, and 24 depend from and contain all the limitations of claim 1 and are asserted to distinguish from the reference in the same manner as claim 1. Claim 30 differs from claim 1 only in reciting nanofilaments instead of carbon nanotubes and is asserted to distinguish from the reference in the same manner as claim 1. Further, as to claims 33 and 37, dependent on claims 1 and 30 respectively Dai does not disclose that the substrate is substantially free of catalyst. The only methods Dai discloses for forming the nanotubes is from catalyst that is placed on the substrate.

Claim Rejections – 35 U.S.C. § 103

Claims 5 and 7-9 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Watanabe.

The Examiner stated that Watanabe's disclosure of sizes of nanotubes and sizes of the gap between the electrodes overlaps the claimed nanotube densities in these claims. However, the claimed nanotube density is in units of μm^{-2} . The density is the number of nanotubes per unit area of substrate. This density is not related to the dimensions of the tubes. Nanotubes of a

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given size may be used to form both high and low densities, depending on the number of tubes present. Watanabe does not disclose any densities.

Further, as stated above, Watanabe is disqualified as to any unclaimed subject matter. The claims do not recite any densities or nanotube dimensions.

Claims 18, 23, 25, and 29 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Watanabe in view of Tuominen (US 2002/0158342).

Tuominen discloses patterned arrays on flexible substrates. The Examiner stated that it would be obvious to make a flexible substrate from a material suggested by Watanabe, motivated by the advantages a flexible substrate provides in a display. However, displays are not mentioned Watanabe, so there is no suggestion to use a substrate that would be appropriate for a display, such as a flexible material.

As stated above, Watanabe is disqualified as to any unclaimed subject matter, including the limitation that none of the nanotubes contact both leads.

In view of the foregoing, it is submitted that the application is now in condition for allowance.

In the event that a fee is required, please charge the fee to Deposit Account No. 50-0281, and in the event that there is a credit due, please credit Deposit Account No. 50-0281.

Respectfully submitted,



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